

X series solar charger inverter 1000W to 12000W



User's Manual

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1. Important safety information



WARNING!

This manual contains important instructions for all X series inverter/charger models that shall be followed during installation and maintenance of inverter.

1.1. General safety precautions

1. Before installing and using X series inverter/charger, read all instructions and cautionary markings on X series inverter /charger and all appropriate sections of this guide. Be sure to read all instructions and cautionary markings for any equipment attached to this unit.
2. This unit is designed for indoor use only. Do not expose X series inverter/charger to rain, snow, or spray.
3. To reduce risk of fire hazard, do not cover or obstruct ventilation openings. Do not install X series inverter/charger in a zero-clearance compartment. Overheating may result.
4. Use only attachments recommended or sold by manufacturer. Doing otherwise may result in a risk of fire, electric shock, or injury to persons.
5. To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate X series inverter/charger with damaged or substandard wiring.
6. Do not operate X series inverter/charger if it has received a sharp blow, been dropped, or otherwise damaged in any way. If X series inverter/charger is damaged, see warranty section.
7. Do not disassemble X series inverter/charger. It contains no user-serviceable parts. See warranty for instructions on obtaining service. Attempting to service X series inverter/charger yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.
8. X series inverter/charger contains more than one live circuit (batteries and AC line). Power may be present at more than one source. To reduce risk of electrical shock, disconnect both AC and DC power from X series inverter/charger before attempting any maintenance or cleaning or working on any circuits connected to X series inverter/charger. Turning off controls will not reduce this risk.
9. Use insulated tools to reduce the chance of short-circuits when installing or working with inverter, the batteries, or PV array.

1.2. Precautions when working with batteries

1. Make sure area around battery is well ventilated.
2. Never smoke or allow a spark or flame near engine or batteries.
3. Use caution to reduce risk of dropping a metal tool on battery. It could spark or short circuit battery or other electrical part and could cause an explosion.
4. Remove all metal items, like rings, brace lets, and watches when working with lead-acid batteries. Lead-acid batteries produce a short circuit current high enough to weld metal to skin, causing a severe burn.

5. Have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
6. Have plenty of fresh water and soap near by in case battery acid contacts skin, clothing, or eyes.
7. Wear complete eye protection and clothing protection. Avoid touching your eyes while working near batteries.
8. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and get medical attention immediately.
9. If you need to remove a battery, always remove grounded terminal from battery first. Make sure all accessories are off so you don't cause a spark.
10. Always use identical types of batteries.
11. Never install old or untested batteries. Check each battery's date code or label to ensure age and type.
12. Batteries are temperature sensitive. For optimum performance, they should be installed in a stable temperature environment.
13. Always recycle old batteries. Contact your local recycling center for proper disposal information.

2. Introduction

2.1. General information

Thank you for purchasing X series inverter/charger.

X series inverter/charger is a combination of an inverter, charger, solar power and auto-transfer switch into one complete system. It is packed with unique features and it is one of the most advanced inverter/chargers in the market today.

The inverter features an AC pass-through circuit, powering your home appliances from utility or generator power while charging battery. When utility power fails, battery backup system keeps your appliances powered until utility power is restored. Internal protection circuits prevent over-discharge of batteries by shutting down inverter when a low battery condition occurs. When utility or generator power is restored, inverter transfers to AC source and recharges batteries.

Accessories allow X series inverter/charger to also serve as a central hub of a renewable energy system. Set X series inverter/charger to battery priority mode, designates inverter-preferred UPS configuration. In this configuration, load power is normally provided by inverter. However, if inverter output is interrupted, an internal transfer switch automatically transfers load from inverter to commercial AC power. Transfer time between inverter and line is short (6ms typical), and such transfers are normally not detected by even highly sensitive loads. Upon restoration of inverter power, inverter will transfer back to inverter power.

On the line priority mode, when utility AC power cuts off (or falls out of acceptable range), transfer relay is de-energized and load is automatically transferred to inverter output. Once qualified AC utility is restored, relay is energized and load is automatically reconnected to AC utility.

It features power factor corrected, sophisticated multi-stage charging and pure sine wave output with unprecedented high surge capability to meet demanding power needs of inductive loads without endangering the equipment.

X series inverter/charger is equipped with a powerful charger of up to 120Amp (depending on model). Its overload capacity is 300% of continuous output for up to 20 seconds to reliably support tools and equipment longer.

Another important feature is that inverter can be easily customized to battery priority via a DIP switch, this helps to extract maximum power from battery in renewable energy systems. Thus, X series inverter/charger is suitable for renewable energy system, utility, RV, marine and emergency appliances.

To get the most out of power inverter, it must be installed, used and maintained properly. Please read the instructions in this manual before installing and operating.

2.2. Application

Power tools – circular saws, drills, grinders, sanders, buffers, weed and hedge trimmers, air compressors

Office equipment – computers, printers, monitors, facsimile machines, scanners

Household items – vacuum cleaners, fans, fluorescent and incandescent lights, shavers, sewing machines

Kitchen appliances – coffee makers, blenders, ice makers, toasters

Industrial equipment – metal halide lamp, high – pressure sodium lamp

Home entertainment electronics – television, VCRs, video games, stereos, musical instruments, satellite equipment

2.3. Features

- ▼ Smart remote control (RMT)
- ▼ Battery temperature sensor (BTS)
- ▼ Automatic generator starting (AGS)
- ▼ Support solar panel with MPPT function
- ▼ Designed to operate under harsh environment
- ▼ DC start & automatic self-diagnostic function
- ▼ Compatible with both linear & non-linear load
- ▼ Easy to install & easy to operate & easy to solve
- ▼ Low DC voltage supports home & office appliances
- ▼ Powerful charge rate up to 120Amp, selectable from 0%-100%
- ▼ High efficiency design & "Power Saving Mode" to conserve energy
- ▼ Battery priority mode, designates inverter-preferred UPS configuration
- ▼ 13 VDC battery recover point, dedicated for renewable energy systems
- ▼ 8 pre set battery type selector plus de-sulphation for totally flat batteries
- ▼ 4-step intelligent battery charging, PFC (power factor correction) for charger
- ▼ 8ms typical transfer time between utility & battery, guarantees power continuity
- ▼ 15s delay before transfer when AC resumes, protection for load when used with generator

2.4. Electrical performance

2.4.1. Inverter

Topology

X series inverter is built according to the following topology:

Inverter: full bridge topology

AC charger: isolate boost topology

Solar charger: MPPT PV controller

Because of high efficiency MOSFETs and 16bit, 4.9MHz microprocessor and heavy transformers, it outputs pure sine wave AC with an average THD of 10% (Min 5%, Max 15%) depending of load connected and battery voltage.

The peak efficiency of X series inverter/charger is 88%.

Overload capacity

X series inverter/charger has different overload capacities, making it ideal to handle demanding loads.

1. For $110\% < \text{load} < 125\% (\pm 10\%)$, no audible alarm in 14 minutes, beeps 0.5s every 1s in the 15th minute, and fault (turn off) after the 15th minute.
2. For $125\% < \text{load} < 150\% (\pm 10\%)$, beeps 0.5s every 1s and fault (turn off) after the 1 minute.
3. For $300\% \geq \text{load} > 150\% (\pm 10\%)$, beeps 0.5s every 1s and fault (turn off) after 20s.

2.4.2. AC charger

X series charger is equipped with an active PFC (power factor correction) multistage battery charger. The PFC feature is used to control amount of power used to charge batteries in order to obtain a power factor as close as possible to 1.

Unlike other inverters whose max charging current decreases according to input AC voltage, X series charger is able to output max current as long as input AC voltage is in the range of 164-243VAC (95-127VAC for 120V model), and AC frequency is in the range of 48-54Hz (58-64Hz for 60Hz model).

X series charger is with a strong charging current of 120Amp (for 4KW, 12V), and the max charge current can be adjusted from 0%-100% via a liner switch at the right of battery type selector. This will be helpful if you are using our powerful charger on a small capacity battery bank. Fortunately, the liner switch can effectively reduce the max charging current to 20% of its peak.

Choosing "0" in battery type selector will disable charging function.

There are mainly 3 stages:

Bulk charging: This is the initial stage of charging. While bulk charging, charger supplies batteries with controlled constant current, it will remain in bulk charging until absorption charging voltage (determined by the battery type selection) is achieved.

Software timer will measure the time from AC start until battery charger reaches 0.3V below boost voltage, then take this time as T0 and $T0 \times 2 = T1$.

Absorb charging: This is the second charging stage and begins after absorb voltage has been reached. Absorb charging provides batteries with a constant voltage and reduces DC charging current in order to maintain absorb voltage setting.

In this period, inverter will start a T1 timer; charger will keep boost voltage in boost CV mode until T1 timer has run out. Then drop voltage down to float voltage. The timer has a minimum time of 1 hour and a maximum time of 12 hours.

Float charging: The third charging stage occurs at the end of absorb charging time. While float charging, charge voltage is reduced to float charge voltage (determined by battery type selection*). In this stage, batteries are kept fully charged and ready if needed by inverter.

If AC is reconnected or battery voltage drops below 12VDC/24VDC/48VDC, charger will reset the cycle above.

If charger maintains float state for 10 days, it will deliberately reset the cycle to protect battery.

Table 2.5.1 Battery charging processes

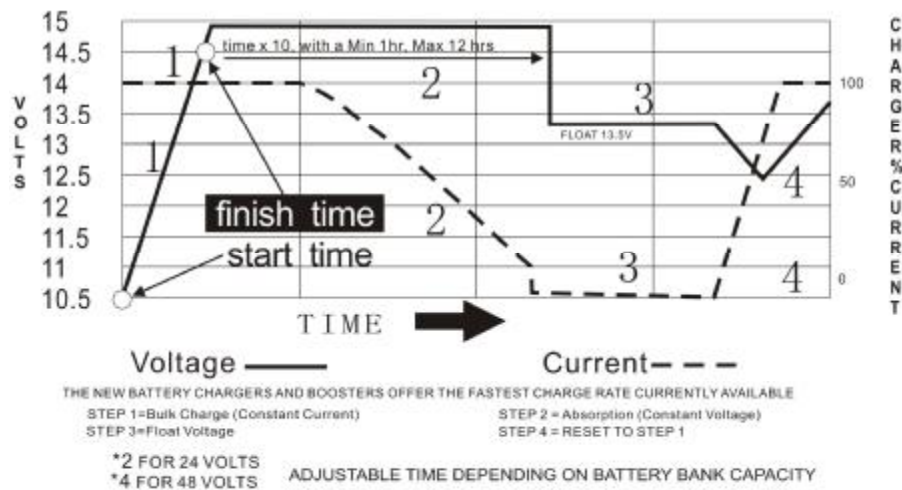


Table 2.5.2 Battery type selector

Switch setting	Description	Fast mode/VDC	Float mode/VDC
0	Charger off		
1	GEL USA	14.0	13.7
2	AGM 1	14.1	13.4
3	LiFePO4	14.6	13.7
4	Sealed Lead Acid	14.4	13.6
5	GEL EURO	14.4	13.8
6	Open Lead Acid	14.8	13.3
7	Calcium	15.1	13.6
8	De-sulphation	15.5 (4 hours then off)	

For 12VDC mode (*2 for 24VDC mode; *4 for 48VDC mode)

De-sulphation

De-sulphation cycle on switch position 8 is marked in red because this is a very dangerous setting if you do not know what you are doing. Before ever attempting to use this cycle you must clearly understand what it does and when and how you would use it.

What causes sulphation? This can occur with infrequent use of batteries (nor), or if batteries have been left discharged so low that they will not accept a charge. This cycle is a very high voltage charge cycle designed to try to break down sulphated crust that is preventing plates taking a charge and thus allow them to clean up and so accept charge once again.

Charging depleted batteries

X series inverter allows start up and through power with depleted batteries.

For 12VDC model, after battery voltage goes below 10V, if switch is still (and always) kept in "ON" position, inverter is always connected with battery, and battery voltage does not drop below 2V, inverter will be able to charge battery once qualified AC inputs are present.

Before battery voltage goes below 9VDC, charging can be activated when switch is turned to "OFF", then to "ON".

When voltage goes below 9VDC, and you accidentally turn switch to OFF or disconnect inverter from battery, inverter will not be able to charge battery once again, because CPU loses memory during this process.

Tabel 2.5.3 AC charging current for X series model

Model/ Watt	Battery voltage	AC charger current/Max	Model/W att	Battery voltage	AC charger current/Max
1,000 ~ 1,500	12VDC	45 ± 5Amp	2,000	12VDC	70 ± 5Amp
	24VDC	25 ± 5Amp		24VDC	35 ± 5Amp
	48VDC	15 ± 5Amp		48VDC	20 ± 5Amp
3,000	12VDC	90 ± 5Amp	4,000	12VDC	120 ± 5Amp
	24VDC	50 ± 5Amp		24VDC	65 ± 5Amp
	48VDC	30 ± 5Amp		48VDC	40 ± 5Amp
5,000	24VDC	80 ± 5Amp	6,000	24VDC	90 ± 5Amp
	48VDC	50 ± 5Amp		48VDC	60 ± 5Amp
8,000	24VDC	120 ± 5Amp	10,000	48VDC	100 ± 5Amp
	48VDC	80 ± 5Amp	12,000	48VDC	120 ± 5Amp

Charging capacity will go to peak in around 3 seconds. This may cause a generator to drop frequency, making inverter transfer to battery mode.

It is suggested to gradually put charging load on generator by switching charging switch from min to max, together with 15s switch delay, inverter gives generator enough time to spin up. This will depend on the size of generator and rate of charge.

2.4.3. Transfer

While in standby mode, AC input is continually monitored. Whenever AC power falls below VAC trip voltage (154VAC, default setting for 230VAC, 90VAC for 120VAC), inverter automatically transfers back to invert mode with minimum interruption to your appliances - as long as inverter is turned on. Transfer from standby mode to inverter mode occurs in approximately 8 milliseconds. And it is the same time from inverter mode to standby mode.

Though it is not designed as a computer UPS system, this transfer time is usually fast enough to keep your equipment powered up.

There is a 15-second delay from the time inverter senses that continuously qualified AC is present at input terminals to when transfer is made. This delay is built in to provide time for a generator to spin-up to a stable voltage and avoid relay chattering. Inverter will not transfer to generator until it has locked onto generator's output. This delay is also designed to avoid frequent switching when input utility is unstable.

2.4.4. Auto frequency adjust

Inverter is with auto frequency adjust function.

The factory default configuration for 220/230/240VAC inverter is 50Hz, and 60Hz for 100/110/120VAC inverter. While output frequency can be easily changed once a qualified freq is applied to the inverter.

If you want to get 60Hz from a 50Hz inverter, just input 60Hz power, and inverter will automatically adjust output frequency to 60Hz and vice versa.

2.4.5. Solar charger

Listed below is specification for solar charger

Table 2.5.4 Solar charge electrical specification @ 25°C

Rated voltage	12VDC	24VDC	48VDC
Rated charge current (includes load current)	40/60Amp		40Amp
Load current	15Amp		
Input voltage range	15-30VDC	30-55VDC	60-100VDC
Max. PV open circuit array voltage	35VDC	60VDC	105VDC
Overload protection (DC load)	2.0 * I(rated)>5s; 1.5 * I(rated)>20s 1.25 * I(rated) temperature controlled		
Typical idle consumption	At idle < 10mA		
Bulk charge	14.6VDC	29.2VDC	58.4VDC
Floating charge	13.4VDC	26.8VDC	53.6VDC
Equalization charge	14.0VDC	28.0VDC	58.0VDC
Over charge disconnect	14.8VDC	29.6VDC	59.2VDC
Over charge recovery	13.6VDC	27.2VDC	54.4VDC
Over discharge disconnect	10.8VDC	21.6VDC	43.2VDC
Over discharge reconnect	12.3VDC	24.6VDC	49.6VDC
Temperature compensation	-13.2mV/°C	-26.4mV/°C	-52.8mV/°C
Lead acid battery settings	Adjustable		
NiCad battery settings	Adjustable		
Low voltage reconnect	12.0-14.0VDC	24.0-28.0VDC	48.0-56.0VDC
Low voltage disconnect	10.5-12.5VDC	21.0-25.0VDC	42.0-50.0VDC
Ambient temperature	0-40°C (full load) 40-60°C (de-rating)		
Altitude	Operating 5000m, non-operating 16000m		
Protection class	IP21		
Battery temperature sensor①	BTS (optional) Remote battery temperature sensor for increased charging precision		
Terminal size (fine/single wire)	#8 AWG		

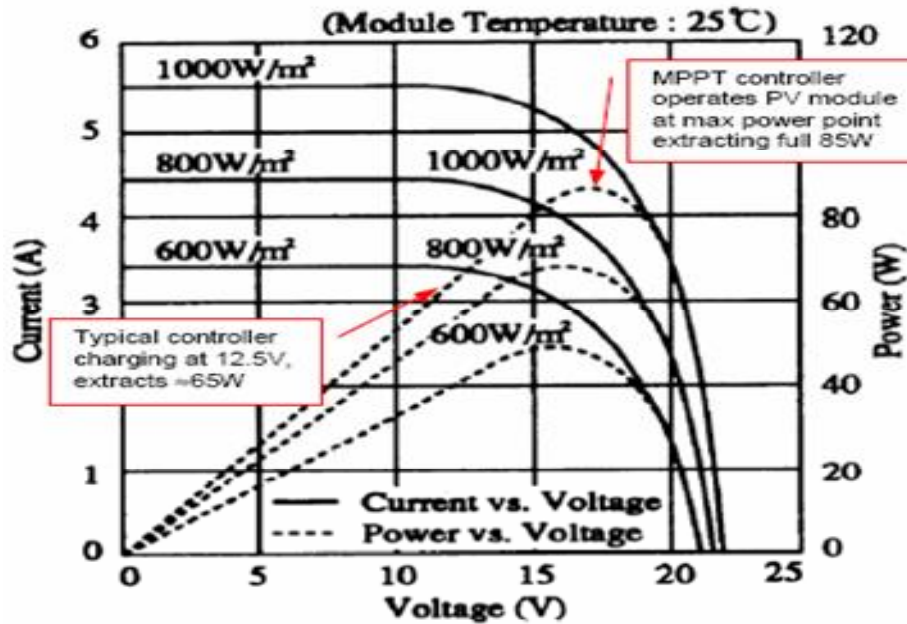
Note:

①Optional battery temperature sensor automatically adjusts charging process of controller according to the type of battery that is selected by user through battery type selector. With battery temperature sensor installed, controller will increase or decrease battery charging voltage depending on the temperature of battery to optimize charge to battery and maintain optional performance of battery.

Maximum power point tracking (MPPT) function

Maximum power point tracking, frequently referred to as MPPT, is an electronic system that operates the photovoltaic (PV) modules in a manner that allows modules to produce all power they are capable of. PV-seeker charge controller is a microprocessor-based system designed to implement MPPT. And it can increase charge current up to 30% or more compared to traditional charge controllers (See Table 2.5.4).

Table 2.5.5 Current, power VS voltage characteristics



Charge controller built in is with 12/24/48V battery voltage auto detecting function.

For 12/24VDC inverter, output voltage of solar charger will be accordingly 12/24VDC, and qualified DC input volt range is 15V-55VDC.

For 48VDC inverter, output voltage of solar charger will be accordingly 48VDC, and qualified DC input volt range is 55V-110VDC.

If the voltage falls out of this range, charger will not work properly. Special attention should be paid to this when configuring the solar array.

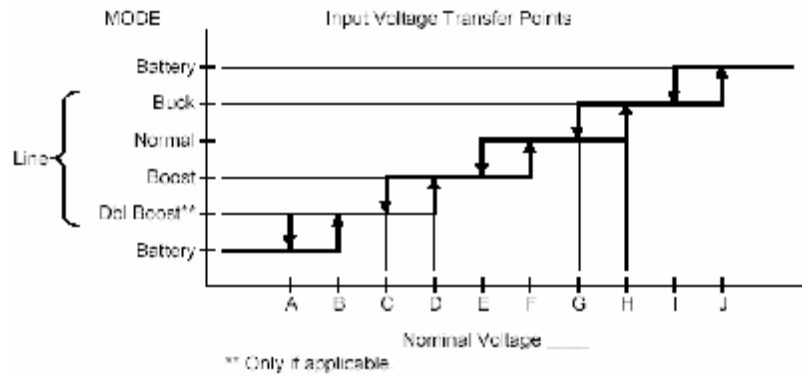
2.4.6. Automatic voltage regulation (optional)

Automatic voltage regulation function is for full of X series pure sine wave inverter/charger except split phase models including X1000W~6000W.

Instead of simply bypassing the input AC to power loads, X series inverter stabilizes input AC voltage to a range of 230V/120V±10%. Connected with batteries, X series inverter will function as a UPS with max transfer time of 10 ms. With all these unique features our inverter provides, it will bring you long-term trouble free operation beyond your expectation.

Function introduction

Table 2.5.5 Input voltage transfer points



X series function (optional)	X series					
	LV (NA/JPN)			HV (INTL)		
Acceptable input voltage range (VAC)	0-160			0-300		
Nominal input voltages (VAC)	100	110	120	220	230	240
(A) Line low loss N/W (on Battery)	75/65	84/72	92/78	168/143	176/150	183/156
(B) Line low comeback N/W (on Boost)	80/70	89/77	97/83	178/153	186/160	193/166
(C) Line 2nd boost threshold (on Boost)	**	**	**	**	**	**
(D) Line 2nd boost comeback (on Normal)	**	**	**	**	**	**
(E) Line 1st boost threshold (on Boost)	90	99	108	198	207	216
(F) Line 1st boost comeback (on Normal)	93	103	112	205	215	225
(G) Line buck comeback (on Normal)	106	118	128	235	246	256
(H) Line buck threshold (on Buck)	110	121	132	242	253	264
(I) Line high comeback (on Buck)	115	127	139	253	266	278
(J) Line high loss (on Battery)	120	132	144	263	276	288

2.4.7. Power saver mode



There are 3 different working statuses for X series inverter: “Power Saver Auto” 、 “Power Saver Off” and “Power Off”.

When power switch is in “Unit Off” position, inverter is powered off.

When power switch is turned to either of “Power Saver Auto” or “Power Saver Off”, inverter is powered on.

Power saver function is designed to conserve battery power when AC power is not or rarely required by the loads.

In this mode, inverter pulses AC output looking for an AC load (i.e., electrical appliance). Whenever an AC load (greater than 25 Watts) is turned on, inverter recognizes need for power and automatically starts inverting and output goes to full voltage. When there is no load (or less than 25 Watts) detected, inverter automatically goes back into search mode to minimize energy consumption from the battery bank.

In “Power Saver On” mode, inverter will draw power mainly in sensing moments, thus idle consumption is significantly reduced. Inverter is factory defaulted to detect load for 250ms every 30 seconds. This cycle can be customized to 3 seconds turn SW3 on DIP switch.



Note: The minimum power of load to take inverter out of sleep mode (Power Saver On) is 25 Watts.

Table 2.5.6 X series idle power consumption

Model	Power Saver Off	Power Saver Auto	
	Idle	3s (Max)	Stand-by mode
1,000W	15W	7.5W	6.6W
1,500W	18W	7.5W	6.6W
2,000W	30W	11.5W	6.6W
3,000W	60W	20.0W	6.6W
4,000W	70W	20.0W	6.6W
5,000W	80W	25.0W	6.6W
6,000W	90W	25.0W	6.6W
8,000W	120W	30.0W	6.6W
10,000W	150W	35.0W	6.6W
12,000W	180W	35.0W	6.6W

When in search sense mode, green power LED will blink and inverter will make a ticking sound. At full output voltage, green power LED will light steadily and inverter will make a steady humming sound. When inverter is used as an “uninterruptible” power supply search sense mode or “Power Saver On” function should be defeated.

Exceptions

Some devices when scanned by load sensor cannot be detected. Small fluorescent lights are the most common example (try altering plug polarity by turning it over). Some computers and sophisticated electronics have power supplies that do not present a load until line voltage is available. When this occurs, each unit waits for the other to begin. To drive these loads either a small companion load must be used to bring inverter out of its search mode, or inverter may be programmed to remain at full output voltage.

2.4.8. Protections

X series inverter is equipped with extensive protections against various harsh situations/faults.

These protections include:

AC input over voltage protection/AC input low voltage protection

Low battery alarm/High battery alarm

Over temperature protection/Over load protection

Short circuit protection (1s after fault)

Back feeding protection

When over temperature/over load occur, after fault is cleared, master switch has to be reset to restart inverter.

Low batter voltage trip point can be customized from defaulted value 10VDC to 10.5VDC through SW1 on DIP switch.

Inverter will go to over temp protection when heat sink temp $\geq 105^{\circ}\text{C}$, and go to fault (shutdown output) after 30 seconds. Switch has to be reset to activate inverter.

X series inverter has back feeding protection which avoids presenting an AC voltage on AC input terminal in invert mode.

After the reason for fault is cleared, inverter has to be reset to start working.

2.4.9. Remote control



Apart from switch panel on the front of inverter, an extra switch panel connected to RJ11 port at the DC side of inverter through a standard telephone cable can also control operation of inverter.

If an extra switch panel is connected to inverter via “remote control port”, together with panel on inverter case, these two panels will be connected and operated in parallel.

Whichever first switches from “Off” to “Power Saver Off” or “Power Saver On”, it will power inverter on.

If commands from the two panels conflict, inverter will accept command according to the following priority:

Power saver on> Power saver off>Power off

Only when both panels are turned to “Unit Off” position will inverter be powered off.

The Max length of cable is 10 meters.

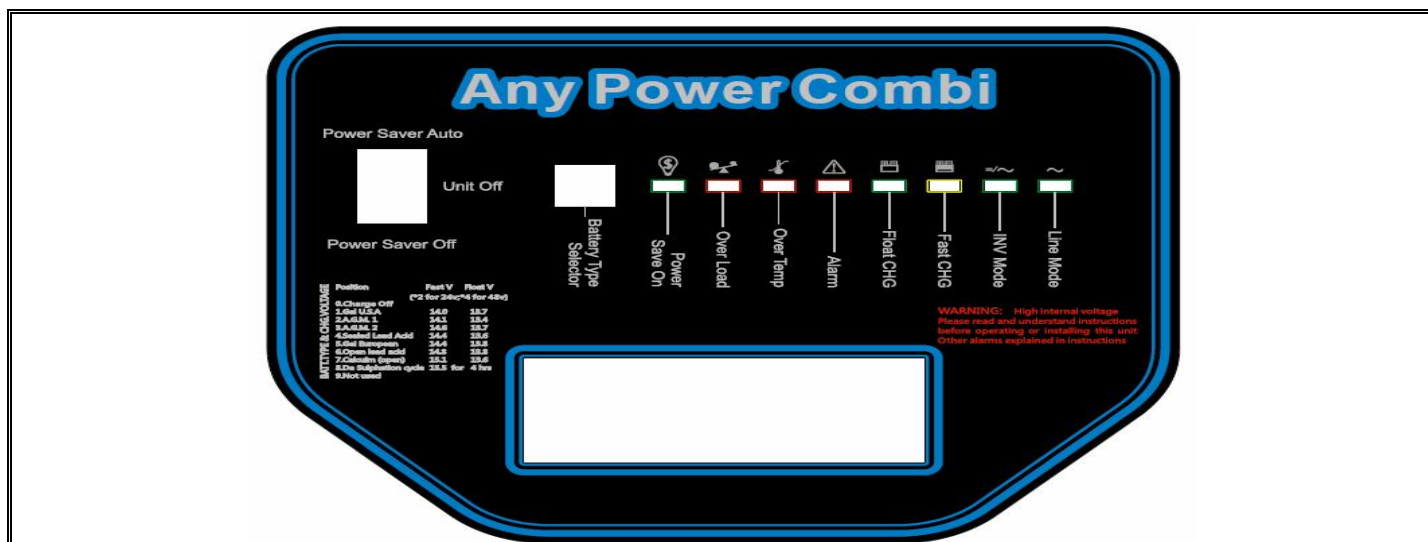


WARNING

Never cut telephone cable when it is attached to inverter and battery is connected to inverter. Even if inverter is turned off. It will damage remote PCB inside if cable is short circuited during cutting.

2.4.10. LED indicator & LCD

Table 2.5.7 X series LED indicators



Line Mode	Green LED lit in AC mode
Inverter Mode	Green LED lit in Inverter mode
Fast Charge	Yellow LED lit in Fast Charging mode
Float Charge	Green LED lit in Float Charging mode
Alarm Mode	Red LED lit in Error state
Over Temp Trip	Red LED lit in Over Temperature
Over Load Trip	Red LED lit in Over Load
Power Saver On	Green LED lit in Power Saver mode

Table 2.5.8 X series LCD indicator

1. Greeting message	2. AC status & input voltage "AC: abnormal" will be displayed when AC input is not qualified.
3. Output voltage/frequency and battery voltage	4. Output current (in percentage)

2.4.11. Audible alarm

Table 2.5.9 X series audible alarm specification

Battery voltage low	Inverter green LED lit, and buzzer beeps 0.5s every 5s.
Battery voltage high	Inverter green LED lit, and buzzer beeps 0.5s every 1s and fault after 60s.
Invert mode over-load	(1)110%<load<125%(±10%), no audible alarm in 14 minutes,

	beeps 0.5s every 1s in 15 th minute and fault after 15 minutes; (2)125% <load<150%(±10%), beeps 0.5s every 1s and fault after 60s; (3)Load>150%(±10%), beeps 0.5s every 1s and fault after 20s;
Over temperature	Heat sink temp. ≥105°C, over temp red LED lighting, beeps 0.5s every 1s;

2.4.12. Fan operation

For 1-3KW, there is one multiple controlled DC fan which starts to work according to the following logic.

For 4-12KW, there is two multiple controlled DC fan and one AC fan. DC fan will work in the same way as the one on 1-3KW, while AC fan will work once there is AC output from inverter.

So when inverter is in power saver mode, AC fan will work from time to time in response to pulse sent the inverter in power saver mode.

Operation of DC fan at DC terminal side is controlled by the following logic (refer to Table 2.5.10):

Table 2.5.10 X series fan operation logic

Condition	Enter condition	Leave condition	Speed
Heat sink temperature	$T \leq 60^{\circ}\text{C}$	$T > 65^{\circ}\text{C}$	OFF
	$65^{\circ}\text{C} \leq T < 85^{\circ}\text{C}$	$T \leq 60^{\circ}\text{C} / T \geq 85^{\circ}\text{C}$	50%
	$T > 85^{\circ}\text{C}$	$T \leq 80^{\circ}\text{C}$	100%
Charger current	$I \leq 15\%$	$I \geq 20\%$	OFF
	$20\% < I \leq 50\%$	$I \leq 15\% / I \geq 50\%$	50%
	$I > 50\%$	$I \leq 40\%$	100%
Load% (INV mode)	Load < 30%	Load ≥ 30%	OFF
	$30\% \leq \text{load} < 50\%$	Load ≤ 20%/load ≥ 50%	50%
	Load ≥ 50%	Load ≤ 40%	100%

Allow at least 30cm of clearance around inverter for air flow. Make sure that air can circulate freely around unit.

Variable speed fan operation is required in invert and charge mode. This is to be implemented in such a way as to ensure high reliability and safe unit and component operating temperatures in an operating ambient temperature up to 50°C.

- Speed to be controlled in a smooth manner as a function of internal temperature and/or current.
- Fan should not start/stop suddenly.
- Fan should run at minimum speed needed to cool unit.
- Fan noise level target <60dB at a distance of 1m.

2.4.13. DIP switches

On the rear panel of inverter, there are 5 DIP switches which enable users to customize performance of device.

Table 2.5.11 X series DIP switch function setting

DIP switch NO.	Switch function	Position: 0	Position: 1
SW1	Low battery trip volt	10.0VDC	10.5VDC

			*2 for 24VDC, *4 for 48VDC	
SW2	AC input range/(AVR)	230VAC HV	184-253VAC/(176-276V AC)	154-253VAC/(150-276V AC)
		120VAC LV	100-135VAC/(92-144V C)	90-135VAC/(78-144VAC)
SW3	Power saver auto setting		Detect load per 5s	Night charge function
SW4	O/P frequency setting		50Hz	60Hz
SW5	Solar/AC priority setting		Utility priority	Solar priority

SW1: Low battery trip volt:

For 12VDC model, low battery trip volt is set at 10.0VDC by typical deep cycle lead acid battery. It can be customized to 10.5VDC using SW1 for sealed car battery, this is to prevent batteries from over-discharging while there is only a small load applied on inverter (*2 for 24VDC, *4 for 48VDC).

SW2: AC Input Range:

There are different acceptable AC input ranges for different kinds of loads.

For some relatively sensitive electronic devices, a narrow input range of 184-253VAC (100-135V for 120VAC model) is required to protect them.

While for some resistive loads which work in a wide voltage range, input AC range can be customized to 154-253VAC (90-135V for 120VAC model), this helps to power loads with the most AC input power without frequent switches to battery bank.

SW3: Power saver auto setting:

Inverter is factory defaulted to detect load for 250ms in every 5 seconds. This cycle can be customized to 3 seconds thru the SW3 on DIP switch.

SW5: Solar/AC priority:

Our inverter is designed with AC priority by default. This means, when AC input is present, battery will be charged first, and inverter will transfer input AC to power load. Only when AC input is stable for a continuous period of 15 days, inverter will start a battery inverting cycle to protect battery. After 1 cycle normal charging and ac through put will be restored.

When you choose battery priority, inverter will inverting from battery despite AC input. Only when battery voltage is reaches low voltage alarm point (10.5V for 12V), inverter transfers to AC input, charges battery, and switches back to battery when battery is charged full. This function is mainly for wind/solar systems taking utility power as back up.

2.4.14. Output socket

Inverter is either equipped with a dual GFCI socket (rated at 30Amps) or a universal socket (rated at 10Amps) for more convenient wiring.

2.4.15. Other features

Battery voltage recovery start

After low battery voltage shut off (10V for 12V model/20V for 24V model/40V for 48V model), inverter is able to restore operation after battery voltage recovers to 13VDC/26VDC/52VDC (with power switch still in the "On" position). This function helps to save

users extra labor to reactivate inverter when low battery voltage returns to an acceptable range in renewable energy systems. Built in battery charger will automatically reactivate as soon as city/generator ac has been stable for 15 seconds.



WARNING

Never leave loads unattended, some loads (like a heater) may cause accident in such cases.

It is better to shut everything down after low voltage trip than to leave your load on, due to the risk of fire.

Auto generator start

Inverter can be customized to start up a generator when battery voltage goes low.

When inverter goes to low battery alarm, it can send a signal to start a generator, and turn the generator off after battery charging is finished.

The auto generator start feature will only work with generators designed to work with this feature. There is an open/closed relay which will be short circuit positive and negative cable from a generator. DC input voltage can vary, but the Max current relay can carry is 16Amp.

Conformal coating

POCASA entire X series inverters have been processed with a conformal coating on PCB making it water, rust, and dust resistant.

3. Installation

3.1. Location

Follow all the local regulations to install inverter:

Please install equipment in a location that is dry, clean, cool and where has good ventilation.

Working temperature: -10°C-40°C

Storage temperature: -40-70°C

Relative humidity: 0%-95%, non-condensing

Cooling: forced air

3.2. DC wiring recommendation

It is suggested battery bank be kept as close as possible to inverter. The following table is a suggested wiring option for 1 meter DC cable.

Please find the following minimum wire size. In case of DC cable longer than 1m, please increase cross section of cable to reduce loss.

Model/ Watt	Battery voltage	Wire gage/Min		Model/W att	Battery voltage	Wire gage/Min	
		0~1.0m	1.0~5.0m			0~1.0m	1.0~5.0m
1,000 ~ 1,500	12VDC	30mm ²	40mm ²	2,000	12VDC	60mm ²	75mm ²
	24VDC	15mm ²	20mm ²		24VDC	30mm ²	45mm ²
	48VDC	10mm ²	15mm ²		48VDC	15mm ²	25mm ²
3,000	12VDC	90mm ²	120mm ²	4,000	12VDC	120mm ²	150mm ²
	24VDC	45mm ²	60mm ²		24VDC	60mm ²	75mm ²

	48VDC	25mm ²	30mm ²		48VDC	30mm ²	40mm ²
5,000	24VDC	75mm ²	95mm ²	6,000	24VDC	90mm ²	120mm ²
	48VDC	40mm ²	50mm ²		48VDC	45mm ²	60mm ²
8,000	24VDC	120mm ²	150mm ²	10,000	48VDC	75mm ²	95mm ²
	48VDC	60mm ²	75mm ²	12,000	48VDC	90mm ²	120mm ²

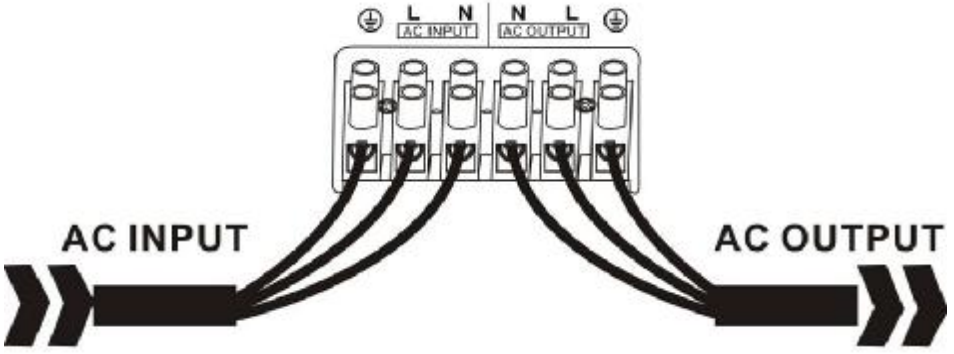
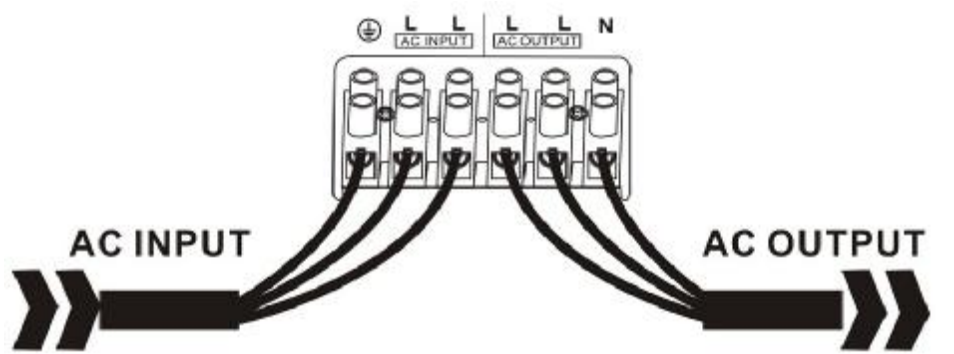
Please note that if there is a problem obtaining for example 90mm² cable, use 2*50mm² or 3*35mm².

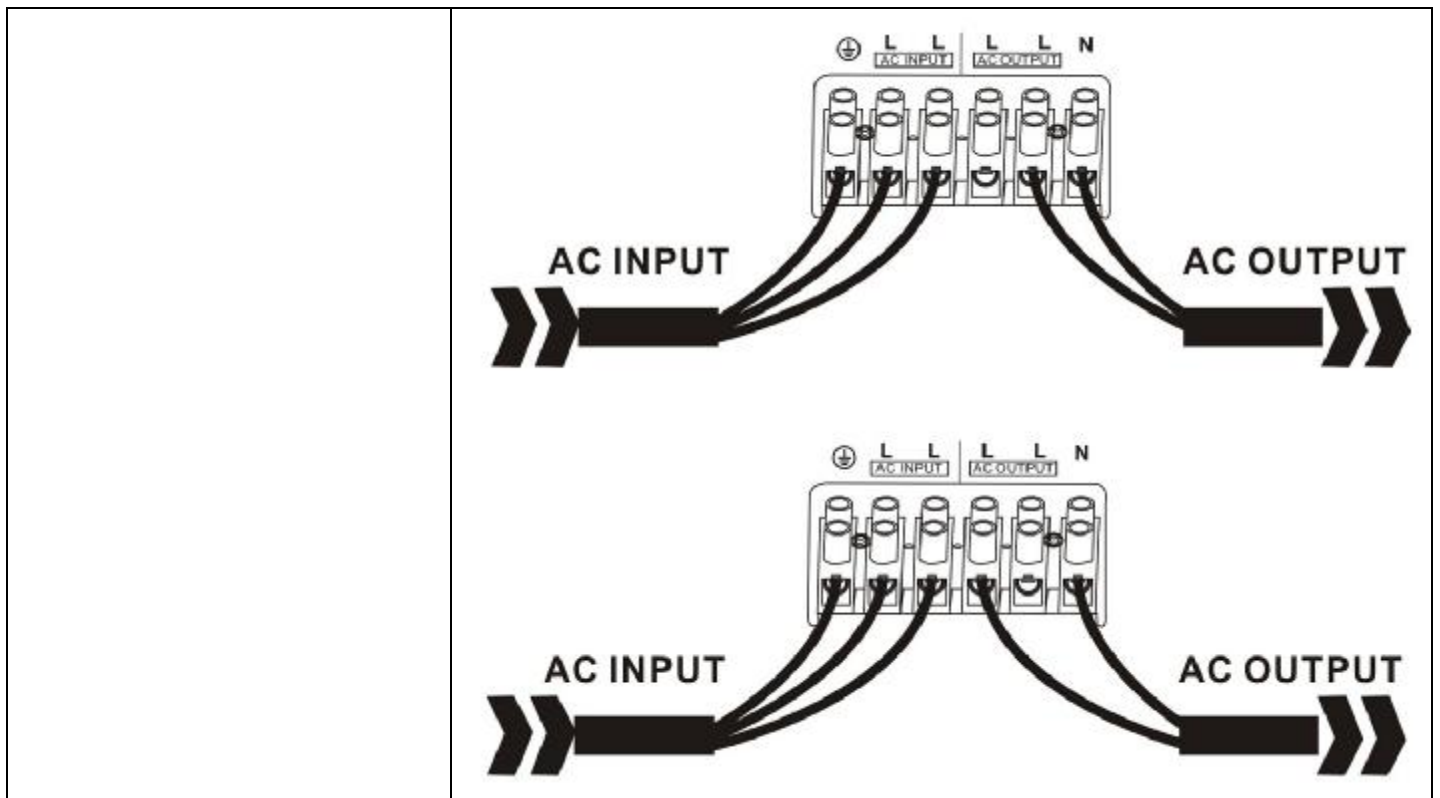
One cable is always best, but cable is simply copper and all you require is copper, so it does not matter if it is one cable or 10 cables as long as square area adds up. Performance of any product can be improved by thicker cable and shorter runs, so if in doubt round up and keep length as short as possible.

3.3. AC wiring

We recommend using 10-5Awg wire to connect to the ac terminal block.

There are 3 different ways of connecting to terminal block depending on model. All the wirings are CE compliant, call our tech support if you are not sure about how to wire any part of your inverter.

Wiring option 1 230V single phase/120V single phase Input: Hot line + Neutral + Ground Output: Hot line + Neutral + Ground	
Wiring option 2 230V split phase Input: Hot line + Hot line + Ground Output: Hot line + Hot line + Neutral	
Wiring option 3 230V split phase Input: Hot line + Hot line + Ground Output: Hot line + Neutral Remark: in such cases, each output hotline can only carry a max of half the rated capacity.	



4. Troubleshooting guide

Troubleshooting contains information about how to troubleshoot possible error conditions while using the X series inverter/charger. The following chart is designed to help you quickly pinpoint the most common inverter failures.

Indicator and buzzer

Status	Item	Indicator on front panel								Indicator on remote module			Buzzer
		Utility Power On	Inverter On	Fast Charge	Float Charge	Alarm	Over-temp Trip	Over-load Trip	Power Save On	Charger On	Inverter On	Alarm	
Line mode	C.C	√	×	√	×	×	×	×	×	√	×	×	×
	C.V	√	×	√, Blink	×	×	×	×	×	√	×	×	×
	Float	√	×	×	√	×	×	×	×	√	×	×	×
	Standby	√	×	×	×	×	×	×	×	×	×	×	×
Inverte r mode	Inverter on	×	√	×	×	×	×	×	×	×	√	×	×
	Power saver	×	×	×	×	×	×	×	√	×	×	×	×
Inverte r mode	Battery low	×	√	×	×	√	×	×	×	×	√	√	Beep 0.5s every 5s
	Battery high	×	√	×	×	√	×	×	×	×	√	√	Beep 0.5s every 1s
	Overload on inverter mode	×	√	×	×	√	×	√	×	×	√	√	Refer to “Audible alarm”
	Over-temp on inverter mode	×	√	×	×	√	√	×	×	×	√	√	Beep 0.5s every 1s
	Over-temp on line mode	√	×	√	×	√	√	×	×	√	×	√	Beep 0.5s every 1s
	Over charge	√	×	√	×	√	×	×	×	√	×	√	Beep 0.5s every 1s
Fault mode	Fan lock	×	×	×	×	×	×	×	×	×	×	×	Beep continuous
	Battery high	×	√	×	×	×	×	×	×	×	√	×	Beep continuous
	Inverter mode overload	×	×	×	×	×	×	√	×	×	×	×	Beep continuous
	Output short	×	×	×	×	√	×	√	×	×	×	√	Beep continuous
	Over temp	×	×	×	×	×	√	×	×	×	×	×	Beep

Fault mode													continuous
	Over charge	x	x	√	x	x	x	x	x	√	x	x	Beep continuous
	Back feed short	x	x	x	x	x	x	x	x	x	x	x	Beep continuous

Symptom	Possible cause	Recommended solution
Inverter will not turn on during initial power up.	Batteries are not connected, loose battery-side connections.	Check the batteries and cable connections. Check DC fuse and breaker.
	Low battery voltage	Charge the battery
No AC output voltage and no indicator lights ON	Inverter has been manually transitioned to OFF mode.	Press the switch to Power Saver On or Power Saver Off position.
AC output voltage is low and inverter turns loads OFF in a short time.	Low battery	Check condition of batteries and recharge if possible.
Charger is inoperative and unit will not accept AC.	AC voltage has dropped out-of-tolerance.	Check AC voltage for proper voltage and frequency.
Charger is supplying a lower charge rate.	Charger controls are improperly set.	Refer to the section on adjusting "Charger Rate"
	Low AC input voltage	Source qualified AC power.
	Loose battery or AC input connections.	Check all DC /AC connections.
Charger turns OFF while charging from generator.	High AC input voltages from generator	Load generator down with a heavy load. Turn generator output voltage down.
Sensitive loads turn off temporarily when transferring between grid and inverting.	Inverter's low voltage trip voltage may be too low to sustain certain loads.	Choose narrow AC voltage in the DIP switch, or install a UPS if possible.
Noise from transformer/case*	Applying specific loads such as hair drier	Remove loads.

*The reason for the noise from transformer and/or case

When in inverter mode sometimes transformer and/or case of inverter may vibrate and make noise.

If noise comes from transformer:

According to characteristics of our inverter, mainly there is one type of load which most likely may cause rattles of transformer.

That is half wave load: a load that uses only half cycle of power (see figure 1). This tends to cause an imbalance of magnetic field of transformer, reducing its rated working frequency from 20KHz to maybe 15KHz (it varies according to different loads). In such a case the frequency of noise falls exactly into the range (200Hz-20KHz) that human ears can hear.

The most common load of such kind is a hair drier.

If noise comes from these cases:

Normally when loaded with inductive loads, magnetic field generated by transformer keeps attracting or releasing steel case at a specific frequency, this may also cause noise.

Reducing load power or using an inverter with bigger capacity will normally solve this problem.

Noise will not do any harm to inverter or loads.

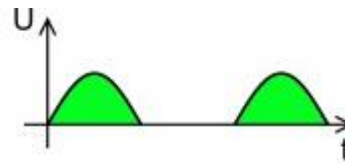


Figure 1 Half cycle load waveform

5. Warranty

We offer a 1 year limited warranty.

The following cases are not covered under warranty.

1. DC polarity reverse

Inverter is designed without DC polarity reverse protection. A polarity reverse may severely damage the inverter.

2. Wrong AC wiring

3. Operating in a wet environment

4. Operating with an undersized generator or generator with unqualified wave form.

6. Order information

Model identification and numbering conventions

X series inverter is identified by model/serial number labels. The serial number can be located on mounting rail or inside of top cover. Model number labels may be located on bottom side of the front cover or possibly inside the front cover. All necessary information is provided on label such as AC output voltage, power and frequency (punch holes).

Appendix 1

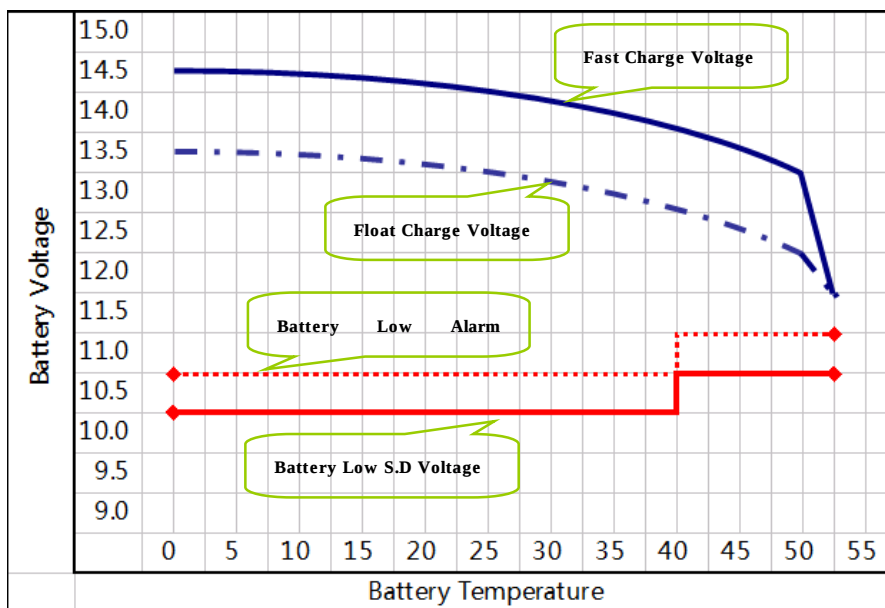
Item	Model	1.0KW	1.5KW	2.0KW	3.0KW	4.0KW	5.0KW	6.0KW	8.0KW	10.0KW	12.0KW
Inverter output	Continuous output power	1.0KW	1.5KW	2.0KW	3.0KW	4.0KW	5.0KW	6.0KW	8.0KW	10.0KW	12.0KW
	Surge rating(20ms)	3.0KW	4.5KW	6.0KW	9.0KW	12.0KW	15.0KW	18.0KW	24.0KW	30.0KW	36.0KW
	Output waveform	Pure sine wave/same as input(bypass mode)									
	Nominal efficiency	>88%(peak)									
	Line mode efficiency	>95%									
	Power factor	0.9-1.0									
	Nominal output voltage rms	100-110-120VAC/220-230-240VAC									
	Output voltage regulation	±10% rms									
	Output frequency	50Hz ± 0.3Hz/60Hz ± 0.3Hz									
	Short circuit protection	Yes(1s after fault)									
	Typical transfer time	10ms(Max)									
	THD	< 10%									
DC input	Nominal input voltage	12.0VDC/24.0VDC/48.0VDC					24.0VDC/48.0VDC		48.0VDC		
	Minimum start voltage	10.0VDC/10.5VDC for 12VDC mode					*2 for 24VDC, *4 for 48VDC;				
	Low battery alarm	10.5VDC/11.0VDC for 12VDC mode									
	Low battery trip	10.0VDC/10.5VDC for 12VDC mode									
	High voltage alarm	16.0VDC for 12VDC mode									
	Low battery voltage recover	15.5VDC for 12VDC mode									
	Idle consumption-search mode	< 25W when power saver on(refer to table)									
Charger	Output voltage	Depends on battery type(refer to Table 2.5.2)									
	Charger breaker rating	10A	15A	20A	20A	20A	30A	30A	40A	40A	40A
	Max charge power rate	1/3 rating power(refer to Table 2.5.3)									
	Battery initial voltage for start	10-15.7VDC for 12VDC mode					*2 for 24VDC, *4 for 48VDC;				
	Over charge protection S.D.	15.7VDC for 12VDC mode									
BTS	Battery temperature sensor	Yes(refer to the table)									
	(optional)	Variances in charging voltage & S.D voltage base on the battery temperature									
Bypass & protection	Input voltage waveform	Sine wave(grid or generator)									
	Nominal voltage	110VAC		120VAC		220VAC	230VAC	230VAC			
	Max input AC voltage	150VAC for 120VAC LV mode; 300VAC for 230VAC HV mode									

	Nominal input frequency	50Hz or 60Hz									
	Low frequency trip	47±0.3Hz for 50Hz, 57±0.3Hz for 60Hz									
	High frequency trip	55±0.3Hz for 50Hz, 65±0.3Hz for 60Hz									
	Overload protection(SMPS load)	Circuit breaker									
	Output short circuit protection	Circuit breaker									
	Bypass breaker rating	10A	15A	20A	30A	40A	40A	40A	50A	63A	63A
	Transfer switch rating	30 Amp for UL & TUV				40 Amp for UL			80 Amp for UL		
	Bypass without battery connected	Yes(optional)									
	Max bypass current	30 Amp				40 Amp			80 Amp		
Solar Charger (Optional)	Rated voltage	12VDC/24VDC/48VDC									
	Solar input voltage range	15-30VDC/30-55VDC/55-100VDC									
	Rated charge current	40~60A									
	Rated output current	15A									
	Self consumption	< 10mA									
	Bulk charge(default)	14.5VDC for 12VDC mode					(*2 for 24VDC, *4 for 48VDC)				
	Floating charge(default)	13.5VDC for 12VDC mode									
	Equalization charge(default)	14.0VDC for 12VDC mode									
	Over charge disconnection	14.8VDC for 12VDC mode									
	Over charge recovery	13.6VDC for 12VDC mode									
	Over discharge disconnection	10.8VDC for 12VDC mode									
	Over discharge reconnection	12.3VDC for 12VDC mode									
	Temperature compensation	- 13.2mV/℃ for 12VDC mode									
Ambient temperature	0~40℃(full load), 40~60℃(derating)										
Mechanical specifications	Mounting	Wall mount									
	Inverter dimensions(L*W*H)	388*415*200mm				488*415*200mm			588*415*200mm		
	Inverter weight(solar charger)Kg	21+2.5	22+2.5	23+2.5	27+2.5	38+2.5	48+2.5	49+2.5	60+2.5	66+2.5	70+2.5
	Shipping dimensions(L*W*H)	550*520*310mm				650*520*310mm			750*520*310mm		
	Shipping weight(solar charger)Kg	23+2.5	24+2.5	25+2.5	29+2.5	40+2.5	50+2.5	51+2.5	62+2.5	68+2.5	72+2.5
	Display	Status LED/status LED+LCD									
	Standard warranty	3 years(optional)									

Appendix 2

Battery temperature compensation

Condition	INV/CHG status	Transfer point
Charger mode	CHG on >>>CHG off	BTS $\geq 50^{\circ}\text{C}$
	CHG off >>> CHG on	BTS $\leq 40^{\circ}\text{C}$
Inverter mode	S.D point + 0.5VDC	$40^{\circ}\text{C} \leq \text{BTS} \leq 50^{\circ}\text{C}$
	Over temp fault	BTS $\geq 50^{\circ}\text{C}$



Default output voltage for float and absorption are at 25°C .

Reduce float voltage follows float voltage and raised absorption voltage follows absorption voltage.

In a adjust mode temperature compensation does not apply.

Note: Specifications subject to change without notice.